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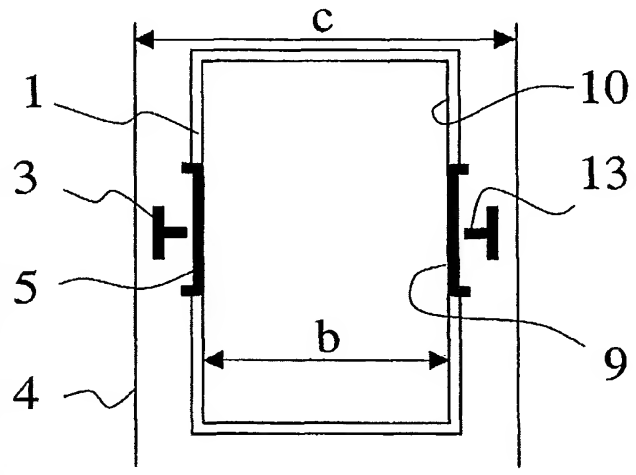
(54) Title: COMPACT ELEVATOR CAR



(57) Abstract: The invention concerns a compact elevator car (1), comprising at least a roof, a floor and two side walls assembled from steel sheet elements (8). Each side wall comprises a reinforcing element (5) having a height substantially equal to that of the elvator car and incorporated in the side wall as a part of it. The reinforcing element (5) has a trough-like recess (14) having a height substantially equal to that of the reinforcing element and opening outwards from the wall of the elevator car, and the guides (6) of the elevator car are so placed relative to the recess (14) that the nose (13) of the car guide rail (3) is in the recess (14) when the guide rail is in contact with the guides (6).

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COMPACT ELEVATOR CAR

The present invention relates to a compact elevator car of light construction as defined in the preamble of claim 1.

In general, the elevator cars used today are not of so-called self-supporting car type; instead, the have a load-bearing frame, to which the car is secured. The car frame is also referred to as car sling. Moreover, the car roof has to be sturdy enough to carry the weight of installers and elevator maintenance personnel working on the car top, and the car floor must bear the weight of elevator passengers or loads of other types. The walls of the car are generally made of thin metal sheet and provided with e.g. longitudinal bends, and they practically need no load-bearing capacity at all. A drawback with an elevator car provided with a car frame is that it requires an elevator shaft with a fairly large cross-sectional area relative to the useful area of the elevator car. A further drawback is that, due to the car frame, the elevator car has a relatively large weight, which again requires a more efficient elevator motor and, in geared elevators, a more efficient gear system. Yet another drawback is that the elevator is difficult to install in narrow shaft spaces because the car frame is often an obstacle that interferes with installation work. An additional problem is a large number of components and, due to this among other reasons, a relatively expensive car.

To remedy the above-mentioned problem, monocoque elevator cars have also been proposed, mainly for small elevators. A prior-art monocoque elevator car is represented by British patent no. 1485610. In the solution according to this patent, the elevator car has two rigid decks, one of which forms the floor of the elevator car and the other the car roof. The floor and the roof are connected to each other by straight wall elements having a load-bearing capacity. According to the invention, the floor and the roof are made from steel plates reinforced by various profiled steel elements. The walls are correspondingly made from steel plates, the inner one of which is bent at the edges to-

wards the second plate while the edges of the second one are bent towards the first one. The space remaining between the steel plates is filled with a material that functions both as reinforcement and as sound insulation material. The car roof is provided with a reinforcing beam, to which the elevator ropes and the upper car guides are fastened. A drawback with this solution is the reinforcing beam mounted on the car top, because it is heavy and an impediment to working on the car top e.g. during maintenance work. Moreover, the beam must be secured to a firm place, so the roof of the elevator car has to be provided with special reinforcements.

The object of the present invention is to overcome the above-mentioned drawbacks and to produce an elevator car without car frame that is economical, easy to install, of good quality and rigid, yet light and space-saving construction, designed for use in elevator solutions of different types. The elevator car of the invention is characterized by what is presented in the characterization part of claim 1. Other embodiments of the invention are characterized by what is presented in the other claims.

The solution of the invention provides the advantage that the elevator car is easy to install at the installation site because it has no car frame that would require space. In addition, the number of components is small as compared with known solutions. This also provides the advantage that the components are easy to transport to the site of installation, and the transportation does not require much space. A further advantage is that the self-supporting elevator car of the invention has a smaller weight and smaller cross-section that the elevator cars used at present, because no car frame is needed. As a result of this, an elevator car designed for the same load can now be placed in a narrower shaft than at present. This brings savings e.g. to the constructor and allows more flexible space utilization in buildings.

In the following, the invention will be described in detail with

reference to an embodiment example and the attached drawings, wherein

Fig. 1 presents a top view of a prior-art elevator car provided with a car frame,

Fig. 2 presents a simplified side view of a prior-art elevator car provided with a car frame,

Fig. 3 presents an elevator car according to the invention in simplified top view,

Fig. 4 presents an elevator car according to the invention in simplified side view, and

Fig. 5 illustrates the wall structure of the elevator car of the invention in a more detailed, simplified top view.

In the solution illustrated in Fig. 1 and 2, a prior-art elevator car 1 is seen as depicted in a simplified form in top view and in side view. The elevator car is surrounded by a relatively heavy and strong car frame 2 constructed from steel beams, which forms a closed frame around the elevator car 1 as shown in Fig. 2. The elevator car 1 is supported on the car frame by elastic supporters 12. The car frame 2 is provided with guides 6 placed in its upper and lower parts and guided by vertical guide rails 3 secured to the wall of the elevator shaft 4. In addition, the car frame is provided with diverting pulleys 7 for the elevator ropes and a safety gear for stopping the elevator car in the event of an emergency by gripping an elevator guide rail 3. The safety gear is not shown in the figures.

Fig. 1 and 2 show clearly how the space required by the car frame increases the size of the shaft, because, in addition to its own thickness, the car frame 2 also requires a clearance 11 between itself and the wall of the elevator car. Therefore, an elevator car having a useful width of "b" in gauge direction requires a total shaft width as indicated by measurement line "a".

A compact elevator car solution according to the invention is

presented in a simplified form in Fig. 3 and . The inside dimension "b" of the elevator car of the invention is the same as the inside dimension of the prior-art elevator car, and yet the elevator car 1 can be accommodated in a much narrower shaft, the required width of which is represented in Fig. 3 by measurement line "c". Since no car frame is used, the extra space that it would require in gauge direction is saved, which means a reduction of about 80-100 mm of the shaft width. In narrow spaces, this is a substantial improvement.

An inventive solution in the elevator car 1 of the invention is a reinforcing element 5 embedded in the side wall as an integral part of it, which element functions like a separate car frame. The reinforcing element 5 has a height substantially equal to or somewhat greater than that of the elevator car. A reinforcing element 5 is mounted in an upright orientation in each sidewall substantially in the middle part of the wall in the horizontal direction or in a position depending on the desired equilibrium. Moreover, the reinforcing element 5 is sunk in the inward direction of the elevator car in such manner that the vertical surface 9 of the reinforcing element facing towards the interior of the elevator car is substantially in the same vertical plane as the rest of the interior surface 10 of the side wall. Thus, the side walls of the elevator car can have smooth surfaces on the inside of the car.

Fig. 5 presents a more detailed view of the wall structure of the invention but in a simplified form and not strictly in scale. The wall consists of e.g. thin steel sheet elements 8 whose long edges are bent perpendicularly to the bottom part of the element. The wall elements 8 are fastened at their bent side edges side by side together. Instead of a normal side wall 8, the side wall has in its middle part a reinforcing element 5 made of stronger steel sheet, whose bottom part is sunk in the direction of the inner part of the elevator car. The long side edges of the reinforcing element are bent to right angles like those of the other side walls 8. Likewise, the reinforcing element 5 is fastened at its bent edges to the adjacent wall ele-

ments 8.

The reinforcing element 5 is substantially deeper in the gauge direction and substantially wider in the widthwise direction than the normal wall elements 8. The reinforcing element 5 has a trough-like recess 14 opening outwards from the wall of the elevator car and having a height substantially equal to that of the reinforcing element, and the guides 6 of the elevator car are so placed relative to the recess 14 that the nose 13 of the car guide rail 3 is in the recess 14 when the guide rail is in contact with the guide 6. Thus, the depth of the cross-sectional form of the reinforcing element 5 and its sinking depth in the inward direction of the elevator car are so chosen that, when the elevator car has been mounted in place, the guide rail nose 13 extends in gauge direction partly to the inside of the outer surface of the wall of the elevator car, into the recess 14 formed by the reinforcing element 5.

The roof and floor of the elevator car are of rigid construction, so the elevator car 1 reinforced by the two symmetrically mounted reinforcing elements 5 is sufficiently rigid to endure the forces imposed on the car without a space-consuming and heavy car frame. The guides 6 are connected to the reinforcing element 5 near the roof and floor of the elevator car. If necessary, the anchorages of the guides are reinforced. Likewise, the diverting pulleys 7 and the safety gear, which are not shown in the drawings, are fastened directly to the elevator car 1 structure near the level of the floor of the elevator car. If necessary, insulating elements are placed between the elevator car 1 and the anchorages of the diverting pulleys 7 and guides 6 to dampen noise that may be produced by the guide rails and elevator ropes and be audible in the elevator car.

It is obvious to the person skilled in the art that the invention is not limited to the example described above, but that it may be varied within the scope of the claims presented below. Thus, for example, the shape and construction of the reinforcing element 5 may differ from those described above. Similarly, the

suspension of the elevator car may be implemented in some other way than by using diverting pulleys 7 as described in the example. Depending on the suspension of the elevator car, the reinforcing elements 5 need not necessarily be placed at the middle of the side walls in the sideways direction; instead, it may vary as required by the structural solution in each case. The guides of the elevator car may also be fastened to the roof and floor of the elevator car or to some other suitable place instead of the reinforcing element 5.

CLAIMS

1. Compact elevator car (1), comprising at least a roof, a floor and two side walls assembled from steel sheet elements (8), **characterized** in that each side wall comprises a reinforcing element (5) having a height substantially equal to that of the elevator car, and that the reinforcing element (5) has a trough-like recess (14) having a height substantially equal to that of the reinforcing element and opening outwards from the wall of the elevator car, and that the guides (6) of the elevator car are so placed relative to the recess (14) that the nose (13) of the car guide rail (3) is in the recess (14) when the guide rail is in contact with the guides (6).

2. Compact elevator car according to claim 1, **characterized** in that the reinforcing element (5) is a substantially upright steel sheet element having its long side edges bent to right angles, said element being incorporated in the side wall as a part of it.

3. Compact elevator car according to claim 1 or 2, **characterized** in that the reinforcing element (5) is made of a material substantially thicker than the other side wall elements (8).

4. Compact elevator car according to claim 1, 2 or 3, **characterized** in that the reinforcing element (5) is secured to the side wall elements (8) adjacent to it in such manner that the reinforcing element is simultaneously sunk in the inward direction of the elevator car.

5. Compact elevator car according to any one of the preceding claims, **characterized** in that the reinforcing element (5) is sunk in the inward direction of the elevator car in such manner that that the inner surface (9) of the reinforcing element (5) is substantially in the same vertical plane with the rest of the interior surface (10) of the side wall.

6. Compact elevator car according to any one of the preceding

claims, **characterized** in that the guides (6) of the elevator car are secured to the upper and lower parts of the reinforcing element (5).

7. Compact elevator car according to any one of the preceding claims, **characterized** in that the depth of the cross-sectional form of the reinforcing element (5) and its sinking depth in the inward direction of the elevator car are so chosen that the nose (13) of the guide rail extends in gauge direction partially inwards through the plane of the outer surface of the wall of the elevator car into the trough-like recess formed by the reinforcing element (5).

8. Compact elevator car according to any one of the preceding claims, **characterized** in that the reinforcing element (5) is mounted in the middle of the side wall in horizontal symmetry.

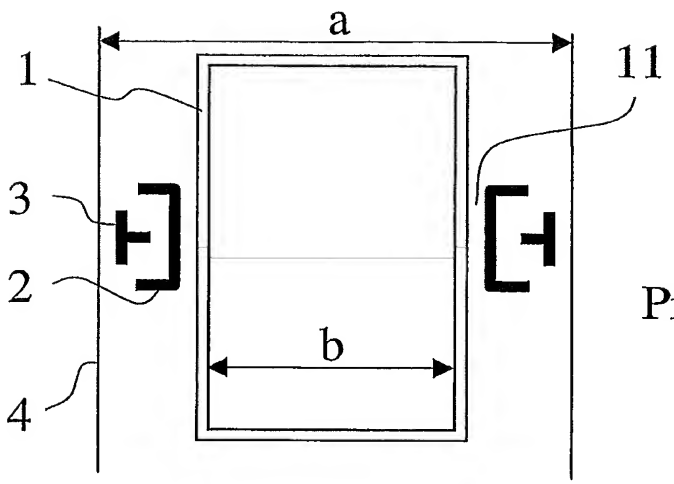

Fig. 1

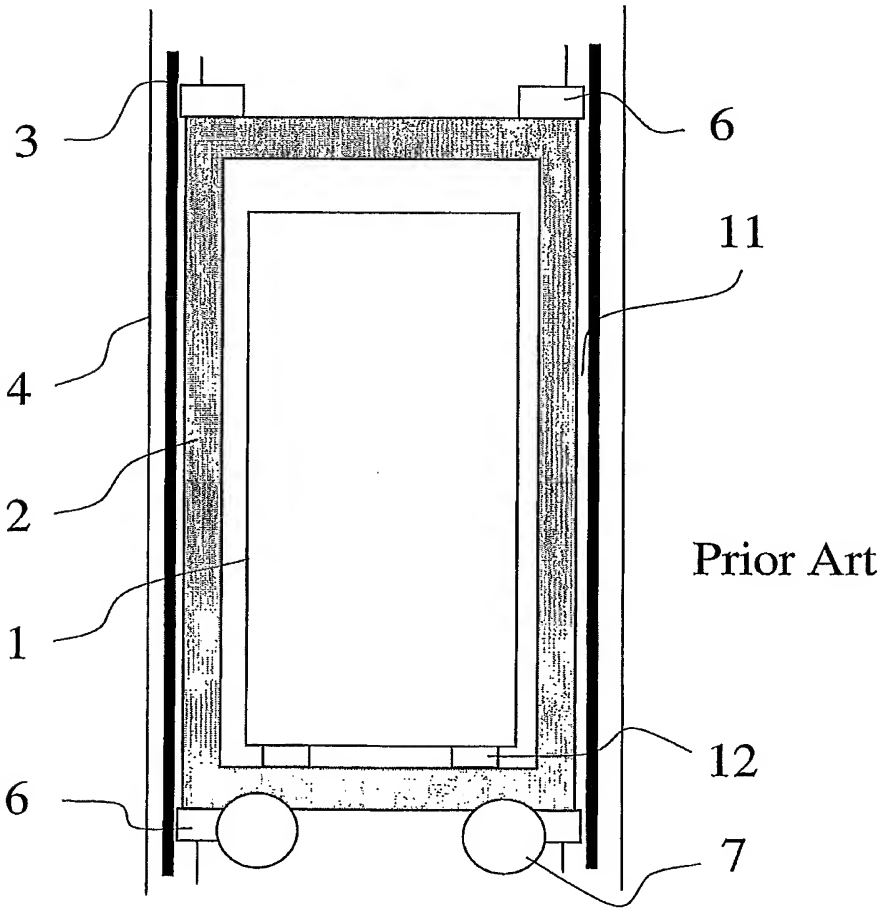

Fig. 2

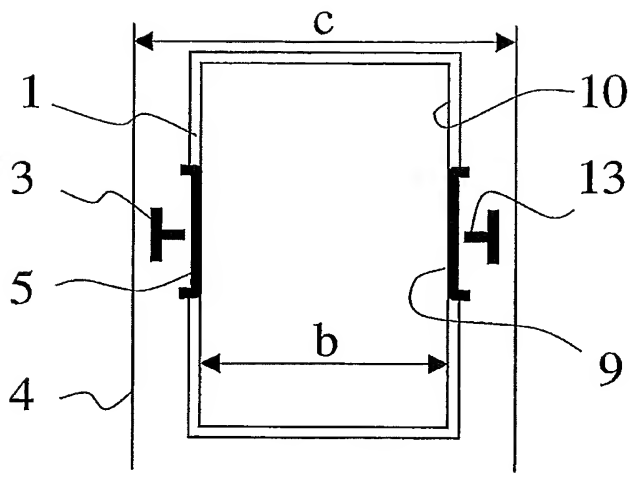

Fig. 3

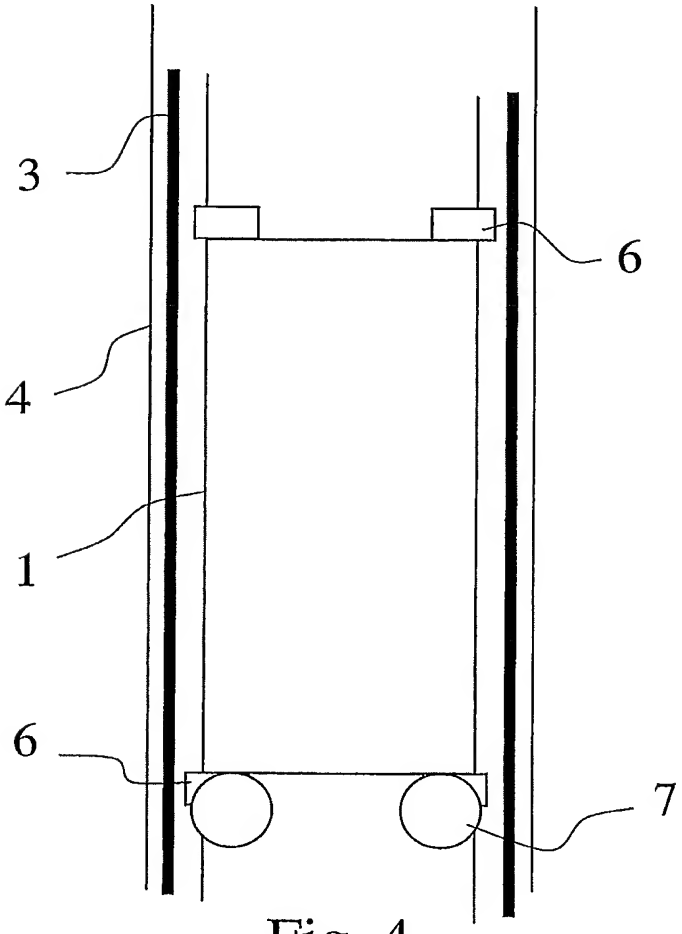

Fig. 4

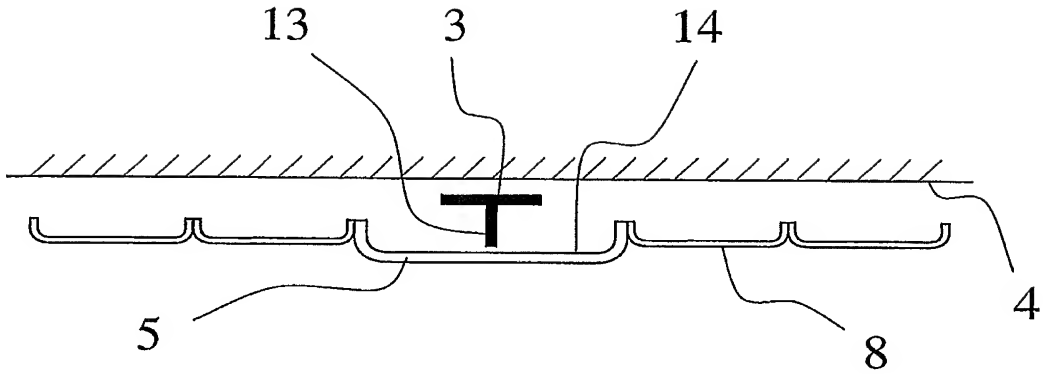

Fig. 5

INTERNATIONAL SEARCH REPORT

Inter al Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B66B11/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B66B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 740 763 A (KADOCHE EMILE) 9 May 1997 (1997-05-09) the whole document ---	1-8
X	GB 496 286 A (EXPRESS LIFT CO LTD;WILLIAM ARTHUR DIXIE) 25 November 1938 (1938-11-25) the whole document ---	1,2
A	WO 99 33743 A (KONE CORP ;PAHKALA KARI (FI); RAESAENEN MATTI (FI); SUORSA ESA (FI) 8 July 1999 (1999-07-08) abstract; figures 1,2 --- -/--	1

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
16 May 2003	06. 06. 03

Name and mailing address of the ISA	Authorized officer
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Interr ial Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 03, 30 March 2000 (2000-03-30) & JP 11 335039 A (MISAWA HOMES CO LTD), 7 December 1999 (1999-12-07) abstract; figures 1-5	1
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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte al Application No
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